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SOME PARASITIC BARNACLES (RHIZOCEPHALA: SACCULINIDAE) FROM PORTUNID CRABS IN MORETON BAY, QUEENSLAND

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ABSTRACT

One new species of *Sacculina* and two new species of *Heterosaccus* are described and additional morphological features of *Sacculina granifera* Boschma 1973 revealed by scanning electron microscopy are recorded.

Only three sacculinids have been reported from Australian waters. Boschma (1933) described *Sacculina duracina* from *Parthenope longimanus* (Leach) at Port Molle, Queensland, and more recently *S. granifera* from *Portunus pelagicus* (Linnaeus) from Moreton Bay, Queensland (Boschma 1973). A further unnamed *Sacculina* sp. from *Thalamita sima* H. Milne-Edwards from Sydney was mentioned by Haswell (1888). *S. granifera* was described only recently although it is a serious parasite of the commercial sand crab (*P. pelagicus*) and has been known for many years (Thomson 1951). In the course of an investigation into the biology of this association, *S. granifera* and three other sacculinids found on different host species were examined primarily to determine whether the other crab species served as reservoir hosts of *S. granifera*. This paper contains descriptions of three previously unnamed sacculinids and further observations on the morphology of *S. granifera*.

MATERIALS AND METHODS

Externae of the parasites were fixed in 5% formalin, Bouin's fluid or 70% alcohol. For sectioning, a small part of the mantle and parts of the visceral mass containing colleteric glands, cypris cell receptacles and ducts were removed, dehydrated and embedded in wax. Sections were cut at 7 – 10μ and were stained in borax carmine or chlorazol black E. Retinacula were observed by mounting small pieces of mantle in balsam and examining the inner surface. Pieces of mantle taken from young, clean externae were prepared for scanning electron microscopy by dehydration in graded alcohols and xylol and coating with gold dust. All measurements are in millimetres unless otherwise stated, and follow the convention illustrated in Fig. 1a where A = anterior to posterior dimension, B = dorsal to ventral dimension (The parasite lies on one side), and C = the left to right dimension i.e. the thickness of the parasite between the crabs abdomen and cephalothorax. Abbreviations used in figures are as follows:

col. gl.	colleteric gland
ex.	excrescences
ext. cut.	external cuticle of mantle
g. coat.	granular coating of mantle
j.	junction of male duct and cypris cell receptacle
l. can.	lymph canals
l.c.r.	left cypris cell receptacle
l.m.d.	left male duct
mant.	mantle
me.	mesentery
m.o.	mantle opening
pap.	papillae
ped.	peduncle
r.c.r.	right cypris cell receptacle
r.m.d.	right male duct
rods	supporting rods of retinaculum
sept.	septae
visc. m.	visceral mass.

Sacculina amplituba nov. sp.
(Fig. 1a – j)

MATERIAL EXAMINED

HOLOTYPE Queensland Museum W7145, ex *Matuta granulosa,* Main channel, Moreton Bay, collector W. Phillips, 6. iv. 1973.

PARATYPES. W7146, a whole specimen, W7147, serial sections, same data as holotype.

DIAGNOSIS

Panduriform parasites occurring singly. Cypris cell receptacles and ducts outside visceral mass, completely separated, receptacles large, roughly globular without septae passing abruptly into ducts; left receptacle terminates on the right side of the mesentery; diameters of ducts widen until equal to that of receptacles, septate. Tubes of colleteric glands arranged in approximately seven rows, greatest division shows 150–160 tubes. External cuticle covered with spiny excrescences of 35μ length formed of hyaline chiton differing from that of the main layers. Retinacula not present. Parasitic on *Matuta granulosa* Miers.

DESCRIPTION

Body form: Mature externae are ovoid to rectangular in shape (Fig. 1a) and brownish in colour except for a pale patch surrounding the posterior stalk. Fine lines can be seen on the mantle, the opening of which is anterior on top of a short muscular tube. Although some specimens were examined other than those designated types, none were found on crabs bearing more than one externa. Dimensions of holotype: A = 15, B = 21, C = 8 and a whole paratype A = 10, B = 15, C = 6.

Cypris cell receptacles: The cypris cell receptables are in the anterior region of the stalk completely separated from the visceral mass (Fig. 1b,f-h). They are roughly globular and without septae and open into the ducts by a narrow aperture (Fig. 1e-g). The ducts widen till they become as wide as the receptacles (Fig. 1d) then narrow near the opening into the mantle cavity. The terminal portion is free in the mantle cavity (Fig. 1c). The internal surface of the duct bears septae (Fig. 1d). The left cypris cell receptacle terminates on the right side of the mesentery (Fig. 1h).

Colleteric glands: The colleteric glands are cushion shaped bodies in the middle portion of the left and right sides of the visceral mass (Fig. 1b). In transverse section in the area of greatest division of tubes, there are 150–160 tubes in up to seven rows. Fig. 1j shows 155 tubes.

Mantle: The external cuticle of the mantle is 75–100μ in thickness and bears clusters of spines 35–40μ in length. The spines are united at their bases in clumps of two to seven; they are of a hyaline chiton different from the cuticle of the mantle (Fig. 1i). As with all sacculinids, granular matter collecting round the excrescences may partially obscure them (Fig. 1i). No retinacula were observed.

REMARKS

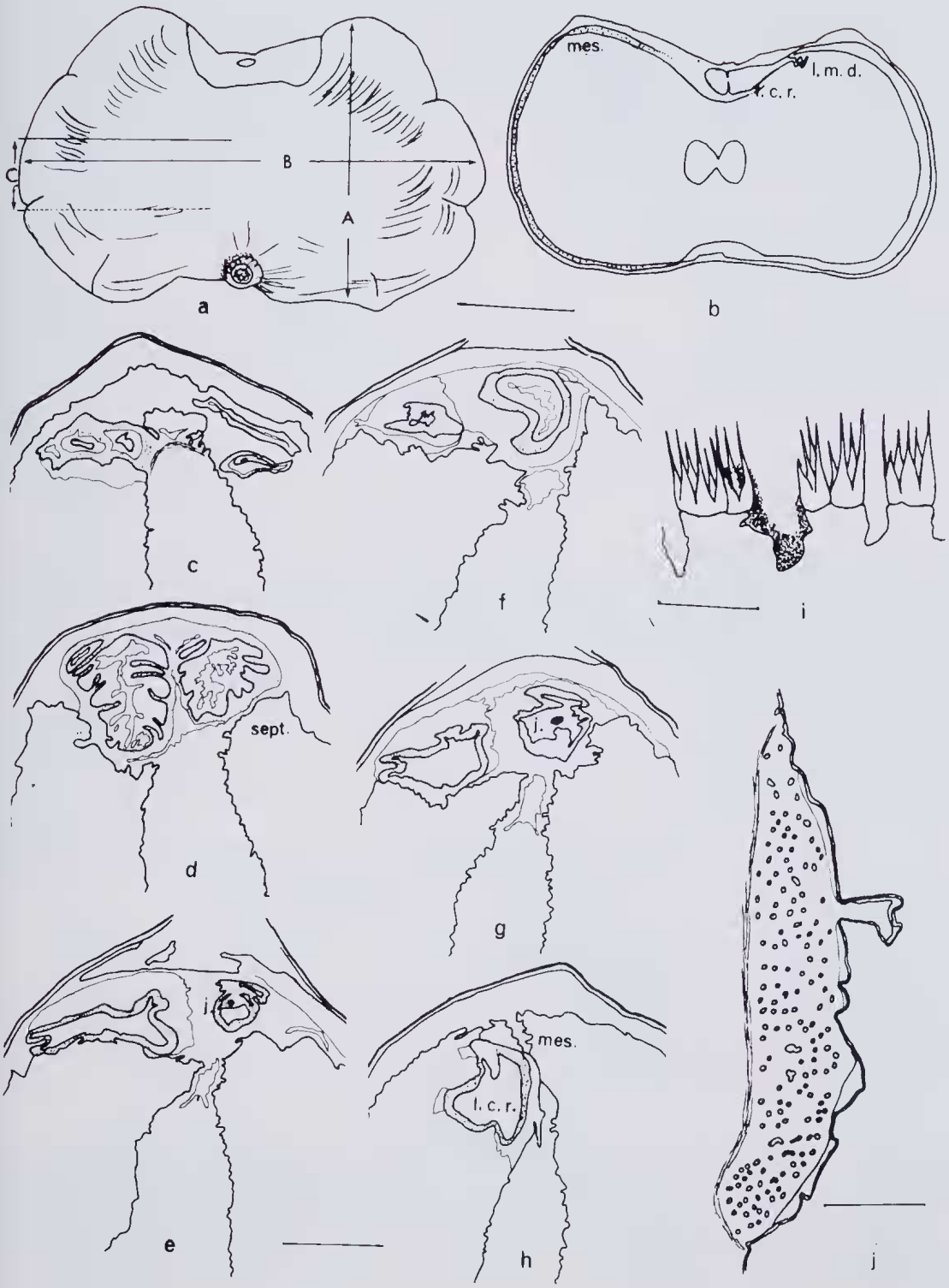
The name *Sacculina amplituba* nov. sp. is proposed because the male ducts widen to a diameter equal to that of the receptacles. In related species the ducts are narrower than the receptacles. *S. amplituba* is similar to *S. beauforti* Boschma 1949 from *Scylla serrata* (Forsk.), *S. leptodiae* Guirin-Ganivit from *Xantho exeratus* (H. Milne-Edwards) and *S. vankampeni* Boschma from *Ozius rugulosus* Stimpson, but differs from these in having (i) ducts as wide as the receptacles whose ends lie free in the mantle cavity as opposed to ducts not as wide as the receptacles and without free ends and (ii) the left receptacle terminating on the right rather than the left. Furthermore, the colleteric glands of *S. beauforti* divide into approximately 50 tubes and those of *S. leptodiae* into less than 20 (Boschma 1949) and so are quite different from the glands in *S. amplituba* which divide into more than 100 tubes. *S. beauforti* has the cuticle of the mantle of 120–130μ in thickness (Boschma 1955) considerably thicker than that of *S. amplituba* (75–100μ thick).

Apart from the morphological distinctions, *S. amplituba* should be considered a new species since each of the most similar species all occur in a different host genus and the work of Fratello (1968) on chromosomes indicates a high degree of host specificity among sacculinids.

Sacculina granifera Boschma, 1973

The most important characteristic of *S. granifera* is the structure of the excrescences of

FIG. 1: *Sacculina amplituba:* a, whole parasite — left side. A, B and C are the anterior to posterior, dorsal to ventral and left to right dimensions respectively; b, left side with left side of mantle removed, scale = 4 mm; c–h, transverse sections of posterior part of parasite showing male organs, scale = 1 mm; i, transverse section of external cuticle of mantle showing excrescences, scale = 40μ; j, transverse section of colleteric gland in region of greatest division of tubes, scale = 300μ.


C
B
A
a
mes.
l. m. d.
l. c. r.
b
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sept.
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j

the external cuticle described as irregularly globular (Boschma 1973). Scanning electron micrographs (Plate 40, Fig. 1,b) reveal that each of the globular excrescences bears many small spines. Further more, Boschma described the colleteric glands of *S. granifera* as dividing into 40 tubes in one row. Specimens examined by me show the colleteric glands to be divided consistently into up to 100 tubes in the region of greatest division.

Heterosaccus lunatus nov. sp.
(Fig. 2 a–i)

MATERIAL EXAMINED

HOLOTYPE Queensland Museum W7148, ex *Charybdis callianassa*, Moreton Bay, collector R. Bishop, Feb. 1975.

PARATYPES Queensland Museum W7149 *ex Charybdis callianassa*, Moreton Bay, collector R. Bishop, Nov. 1974, three whole specimens on one host. Queensland Museum W7150, ex *C. callianassa*, Moreton Bay, collector W. Phillips, 24/v/1973, sections.

DIAGNOSIS

Kidney shaped parasite, more than one of which may occur on the one host. Cypris cell receptacles within visceral mass and deeply crescentic, terminating near colleteric glands and containing sponge-like meshwork. Receptacles open widely into straight ducts also with sponge-like meshwork; ducts open near stalk; receptacles and ducts surrounded by lymph spaces. Colleteric glands posterior, with 60–70 tubes in five to six rows in region of greatest division. External cuticle with papillae 15μ long and 10μ apart, of same material as mantle. Retinacula rounded flaps of tissue occurring singly each with four to six rods. Parasite of *Charybdis callianassa* (Herbst).

DESCRIPTION

Body form: The externa (Fig. 2a) is kidney-shaped having a wide mantle opening with poorly developed musculature. The numbers of externae per crab varies from one to three, the externae being smaller where there are more than one on one host. Dimensions of the holotype: A = 10, B = 19, C = 7; and of whole paratypes (i) A = 10, B = 20, C = 9, (ii) A = 8, B = 13, C = 6, (iii) A = 8, B = 11, C 6.

Cypris cell receptacles: The male organs are confined to the posterior dorsal portion of the visceral mass where they are surrounded by lymph canals. The rest of the visceral mass is without pronounced lymph canals. The ducts which open close to the stalk (Fig. 2,h) are of a consistent diameter of about 400μ and have a sponge-like structure for most of their length. The lumen of each duct is 40–50μ wide. The ducts are not significantly convoluted. They pass gradually into the receptacles which are only slightly wider than the ducts (Fig. 2 d–g). The receptacles have a deep curvature and terminate near the colleteric glands (Fig. 2g).

Colleteric glands: The colleteric glands are cushion-shaped bodies lying in the posterior half of the visceral mass near the middle. In the region of greatest division there are 60–70 tubes in five to six rows (Fig. 2i). There is no chitinous lining but villiform projections are present on the inside.

Mantle: The external cuticle of the mantle is 15–20μ thick and is covered with papillae approximately 15μ long and 10μ apart (Fig. 2c). The papillae are projections of the cuticle of the mantle and may be partially or wholly obscured by a granular coating (Fig. 2b). Scanning electron micrographs (Plate 40, Fig. b) clearly show the shape and distribution of the papillae and the granular coating.

Retinacula (Fig. 2c) are single rounded flaps of tissue about 20μ wide each containing four to six rod–like bodies. The retinacula are about 200μ apart.

REMARKS

The name *Heterosaccus lunatus* nov. sp. is proposed because of the deeply crescentic nature of the cypris cell receptacles.

Heterosaccus multilacinensis nov. sp.
(Fig. 3 a–i)

MATERIAL EXAMINED

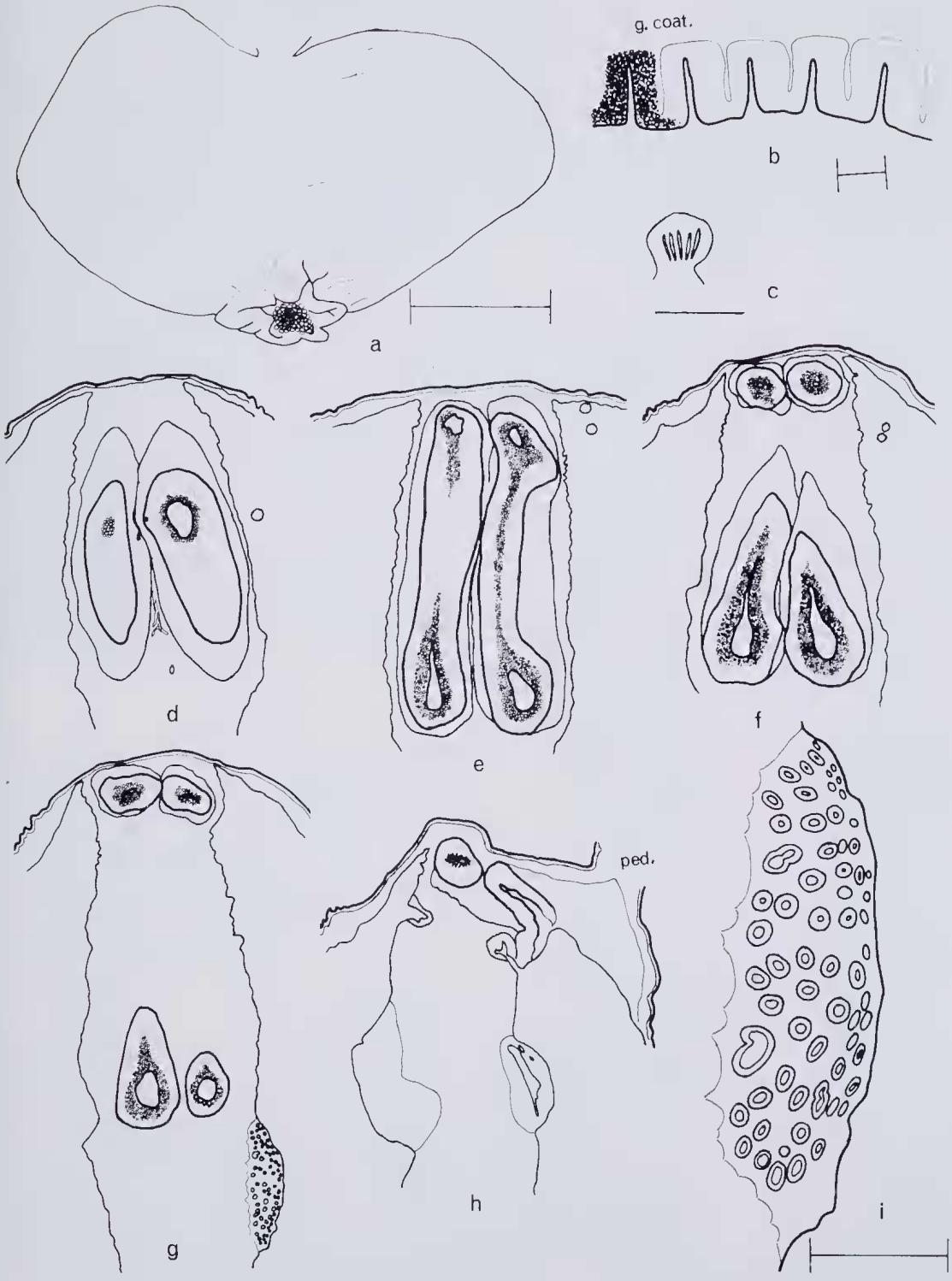
HOLOTYPE Queensland Museum W7151, sections, ex *Carybdis truncata*, East Moreton Bay, collector W. Phillips 6/iv/1973

PARATYPES W7152, ex *C. truncata*, four specimens on host, same data as holotype.

DIAGNOSIS

Kidney-shaped parasite more than one of which may occur on the one host. Cypris cell receptacles

FIG. 2: *Heterosaccus lunatus:* a, whole parasite — left side, scale = 3 mm; b, transverse section of external cuticle of mantle, scale = 10μ; c, internal retinacula, scale = 25μ; d–h, transverse sections of posterior part of parasite showing male organs, scale = 1 mm; i, transverse section of colleteric glands in region of greatest division of tubules, scale = 200μ.


g. coat.
a
b
c
d
e
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ped.
i

shallow crescentic, not surrounded by lymph spaces; ducts slightly convoluted opening away from stalk; meshwork present in receptacles but not in ducts. Colleteric glands in posterior part of visceral mass, region of greatest division of tubes shows 40–60 tubes in four to five rows. External cuticle with papillae 15μ long, close together at base and separated by 5μ at tip. Papillae of same material as cuticle. Retinacula of one to six rounded flaps on a common base with one rod per flap. Parasite of *Charybdis truncata* (Fabricius).

DESCRIPTION

Body form: The externae (Fig. 3a,b) are kidney-shaped with a wide mantle opening showing poorly developed musculature. The number of externae per crab may be more than one. Dimensions of paratypes (i) A = 10, B = 17, C = 4, (ii) A = 9, B = 10, C = 7, (iii) A = 10, B = 19, C = 6, (iv) A = 18, B = 14, C = 4.

Cypris cell receptacles: The male organs are confined to the posterior dorsal portion of the visceral mass and are not surrounded by lymph spaces although lymph spaces are seen commonly in the visceral mass (Fig. 3 a,d–g). The ducts which open close to the stalk are somewhat convoluted and do not possess a sponge-like structure (Fig. 3 e–g). They have a diameter of 220–240μ and the lumen is 50–70μ in diameter. The ducts pass gradually into the receptacles which have a shallow curvature and do possess a sponge-like structure. The receptacles are two to three times as wide as the ducts (Fig. 3 d,e).

Colleteric glands: The cushion shaped colleteric glands are situated in the posterior part of the visceral mass towards the middle. The region of greatest division of tubes shows 40–60 tubes in four or five rows (Fig. 3h). There is no chitinous lining, but the lumen is lined with villiform structures.

Mantle: The external cuticle of the mantle is approximately 50μ thick with papillae 15μ long which are extensions of the cuticle (Fig. 3b). The papillae touch at the bases and taper to a blunt point. They are about 5μ apart at the tips.

Retinacula (Fig. 3e) consist of one to six rounded flaps of chiton on a common base, each flap containing two or three rods which may project out of the flaps and appear to extend into the base. The flaps are from 18–20μ long and spaced about 200μ apart.

REMARKS

The name *Heterosaccus multilacinensis* nov. sp. is proposed because of the many flaps on each retinaculum.

Boschma (1963) described *Heterosaccus papillosus* from several species of the genus *Charybdis* including *C. callianassa*. It is similar to, yet distinct from, the two species described here. *H. lunatus* differs from *H. papillosus* in having (i) wider receptacle ducts opening close to the stalk, (ii) deeper curvature of the receptacles, (iii) greater division of the tubes in more posteriorly placed colleteric glands, (iv) longer more closely placed papillae on the mantle, and (v) retinacula consisting of flaps with rods rather than spindles. *H. multilacinensis* differs from *H. papillosus* in having (i) ducts opening close to the stalk rather than at a distance from the stalk, (ii) shallower curvature of the receptacles, (iii) greater division of tubules in more posteriorly placed colleteric glands, (iv) papillae closer together and of a different shape, and (v) retinacula consisting of many flaps with rods. *H. multilacinensis* differs from *H. lunatus* in having (i) narrower more convoluted male ducts without a sponge-like structure, (ii) less division of the tubes of the colleteric glands, (iii) longer, thicker, more closely packed papillae, and (iv) retinacula consisting of several flaps on one stalk.

DISCUSSION

Undoubtedly the rhizocephalan fauna of Australia will be found to be more numerous than is presently recorded. The influence of these parasites on the biology of their hosts is considerable and where the hosts are of commercial importance they produce considerable losses to the industry. As yet no sacculinid has been found to parasitize the commercial mud crab *Scylla serrata* in Australia although *S. beauforti* and *Loxothylacus ihlei* Boschma 1949 have been described from this species in Indonesia.

Discrimination of species of rhizocephala is difficult since insufficient is known of the details of their life cycles or the variability of characteristics with the age and maturation of the externa. Scanning electron micrographs of the exterior surfaces of the mantle of young externae should provide accurate and detailed information on one rather important taxonomic feature, viz. the form of the cuticular excrescences. Clear differences can be seen between *Sacculina amplituba* and *Heterosaccus lunatus* (Plate 40).

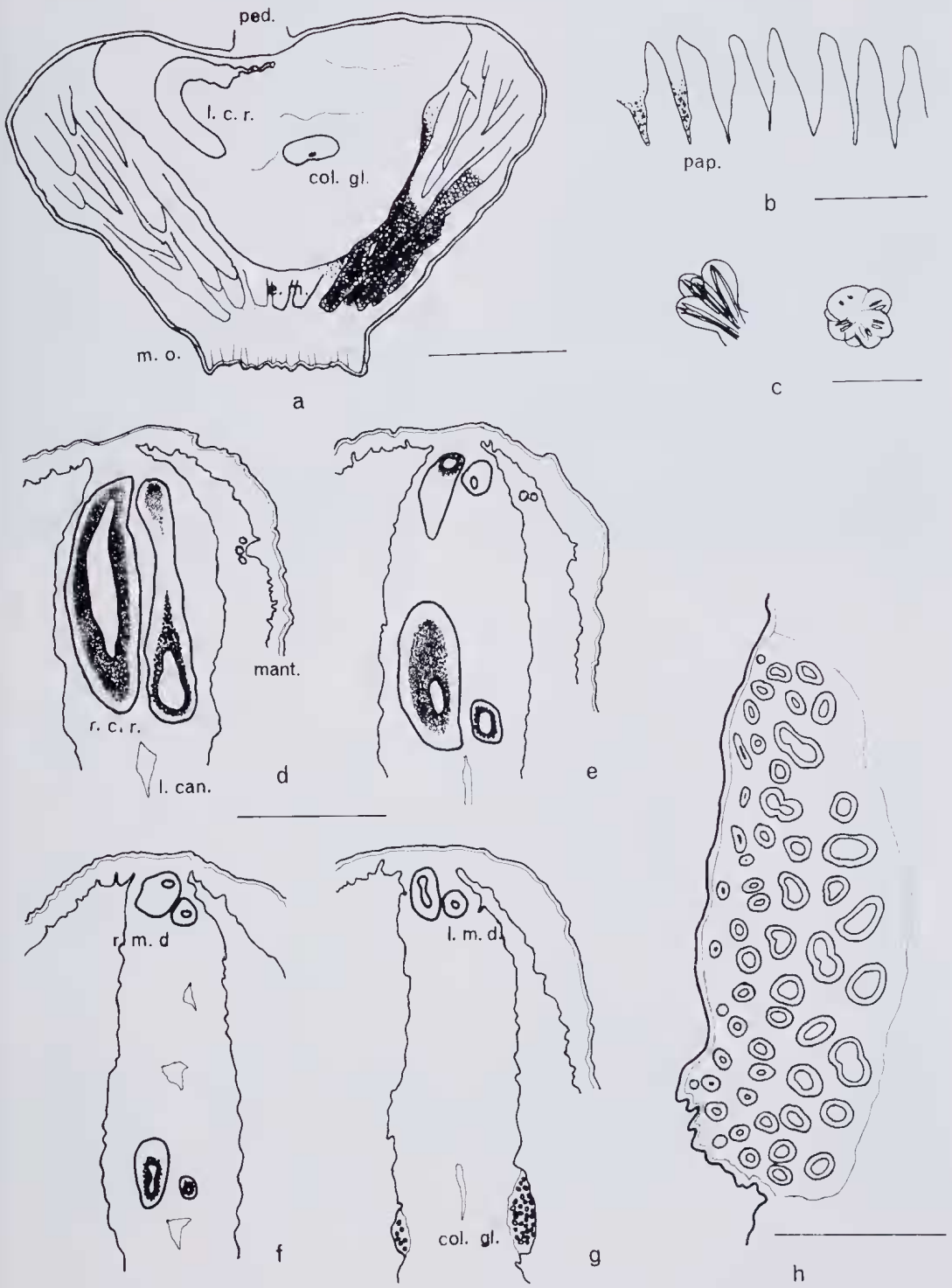

FIG. 3: *Heterosaccus multilacinensis:* a, whole parasite, left side, with left side of mantle removed, scale = 3 mm; b, papillae of external surface of mantle, scale = 10 μ; c, retinacula, scale = 25 μ; d–g, transverse section of posterior part of parasite showing male organs, scale = 1 mm; h, transverse section of colleteric glands in region of greatest division of tubes, scale = 300 μ.

Probably the most promising means of discriminating species would be chromosome techniques as described by Fratello (1968) who was able to discriminate several species previously described as one.

ACKNOWLEDGMENTS

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LITERATURE CITED

Boschma, H., 1933. The Rhizocephala in the collection of the British Museum. *J. Linn. Soc.* **38:** 473–552.

1949. *Sacculina beauforti* and *Losothylacus ihlei*, two Rhizocephala of the crab *Scylla serrata* (Forsk.). *Bijdr. Dierk.* **28:** 41–6.

1955. The described species of the family Sacculinidae. *Zool. Verh., Leiden.* **27:** 1–76.

1967. A Rhizocephalan parasite of the crab *Charybdis callianassa* (Herbst.). *Proc. K. ned. Akad. Wet.* **66C:** 132–3.

1973. *Sacculina granifera* nov. spec., a rhizocephalan parasite of the crab *Portunus (Portunus) pelagicus* (Linnaeus) from the coast of Queensland. *Proc. K. ned. Akad. Wet.* **76C:** 313–8.

Fratello, B., 1968. Cariologia e tassonomia dei Sacculinidi (Cirripedi, Rizocefali). *Caryologia* **21** (4): 359–67.

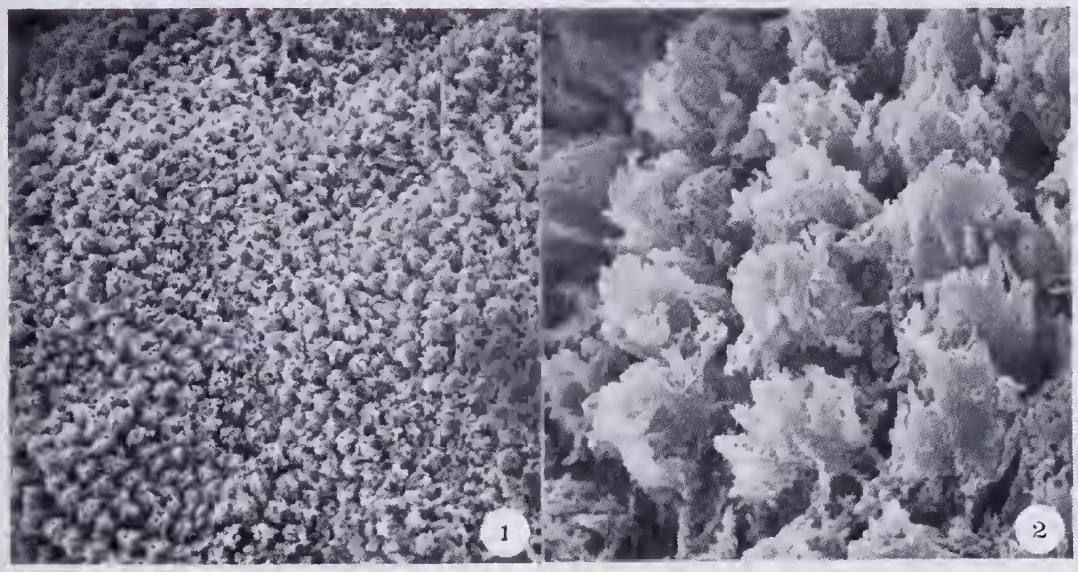
Haswell, W.A., 1888. On *Sacculina* infesting Australian crabs. *Proc. Linn. Soc. N.S.W.* **3:** 1711–2.

Thomson, J.M., 1951. Catch composition of the sand crab fishery in Moreton Bay. *Aust. J. mar. Freshwat. Res.* **2:** 237–44.

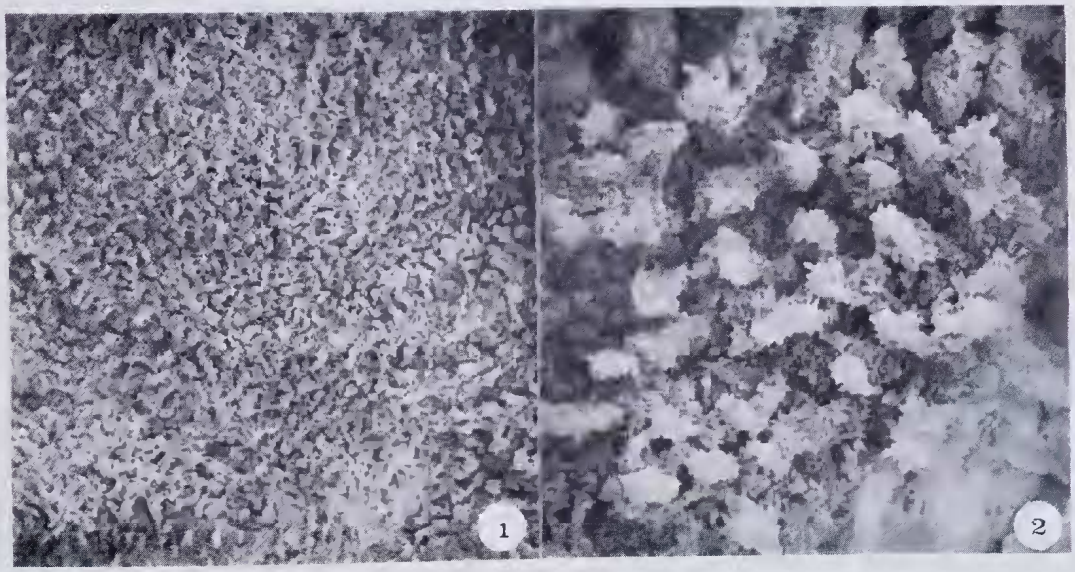
PLATE 40

A: External surface of mantle of *Sacculina granifera* 1. ×500; 2. ×2500

B: External surface of mantle of *Heterosaccus lunatus* 1. ×450; 2. ×1350.



A



B